



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/804,366	03/19/2004	Kyle K. Kirby	2269-6208US (03-0852.00/U)	9222
24247	7590	09/06/2006		EXAMINER
TRASK BRITT P.O. BOX 2550 SALT LAKE CITY, UT 84110				PHAM, THANHHA S
			ART UNIT	PAPER NUMBER
				2813

DATE MAILED: 09/06/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	Application No.	Applicant(s)	
	10/804,366	KIRBY ET AL.	
	Examiner	Art Unit	
	Thanhha Pham	2813	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

1) Responsive to communication(s) filed on 16 June 2006.  
 2a) This action is **FINAL**.                    2b) This action is non-final.  
 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

4) Claim(s) 10-19, 21-28, 45-55 and 57-67 is/are pending in the application.  
 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.  
 5) Claim(s) \_\_\_\_\_ is/are allowed.  
 6) Claim(s) 10-19, 21-28, 45-55 and 57-66 is/are rejected.  
 7) Claim(s) 67 is/are objected to.  
 8) Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

9) The specification is objected to by the Examiner.  
 10) The drawing(s) filed on \_\_\_\_\_ is/are: a) accepted or b) objected to by the Examiner.  
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).  
 11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
 a) All    b) Some \* c) None of:  
 1. Certified copies of the priority documents have been received.  
 2. Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
 3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

1)  Notice of References Cited (PTO-892)  
 2)  Notice of Draftsperson's Patent Drawing Review (PTO-948)  
 3)  Information Disclosure Statement(s) (PTO/SB/08)  
 Paper No(s)/Mail Date \_\_\_\_\_.  
 4)  Interview Summary (PTO-413)  
 Paper No(s)/Mail Date. \_\_\_\_\_.  
 5)  Notice of Informal Patent Application  
 6)  Other: \_\_\_\_\_.

## DETAILED ACTION

This Office Action is in response to Applicant's Amendment dated 06/16/2006.

### *Claim Objections*

**1. Claims 11-17, 19, 22-28, 46-54, 55, 57-63 are objected to because of informalities. Appropriate corrections are required to clarify scope of claims.**

- ▶ With respect to claims 11-17, limitations of "a silicon layer", "a semiconductor substrate", "an etch solution", and "at least one organic solution" referring back and previously cited independent claim should be respectively changed to "the silicon layer", "the semiconductor substrate", "the etch solution", and "the at least one organic solution" to clarify scopes of claims.
- ▶ With respect to claims 19, 22-28, limitations of "a silicon substrate having a HAZ", "at least one of an exposed metal layer, an exposed oxide layer and an exposed nitride layer", "an etch solution", and "at least one organic solvent" referring back and previously cited in independent claim should be respectively changed to "the silicon substrate having the HAZ", "the at least one of the exposed metal layer, the exposed oxide layer and the exposed nitride layer", "the etch solution", and "the at least one organic solvent" to clarify scope of claims.
- ▶ With respect to claims 46-54, limitations of "an etch solution" and "at least one organic solution" referring back and previously cited independent claim should be

respectively changed to “the etch solution” and “the at least one organic solution” to clarify scopes of claims.

- With respect to claim 55, line 7, “an etch solution comprising tetramethylammonium hydroxide (“TMAH”) and at least one organic solvent” should be change to “a first etch solution comprising tetramethylammonium hydroxide (TMAH) and at least one organic solvent” to clarify scope of claim. (see dependent claims cited “first etch solution” – consistent claimed language should be used to clarify scope of claims).
- With respect to claims 57-63, of “a first etch solution” and “at least one organic solution” referring back and previously cited independent claim should be respectively changed to “the first etch solution” and “the at least one organic solution” to clarify scopes of claims.

### ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

1. **Claims 10-14, 18-19, 21-25, 45-49, 53-60, 64 and 67 are rejected under 35 U.S.C. 102(e) as being anticipated by Watkins et al [US 2005/0077913].**

► With respect to claims 10-14, Watkins et al (figs 1-8, text [0001]-[0048]) discloses the claimed method of selectively etching solution comprising:

exposing a silicon layer (10, figs 2E-2F, text [0037]) on a semiconductor substrate (10) to an etch solution comprising a tetramethylammonium hydroxide (TMAH) and at least one organic solvent (propylene glycol), the at least one organic solvent (propylene glycol) comprises at least one hydroxyl group, the at least one organic solvent having at least one hydroxyl group (propylene glycol) that dissociates and forms at least one hydroxyl ion (propylene glycol dissociates and form at least hydroxyl ion); [claims 10-14] and

removing the silicon layer (10, figs 2E-2F) without removing at least one of an exposed metal layer, an exposed oxide layer and an exposed nitride layer (fig 2F, exposed layer 30 is not removed) also present on the semiconductor substrate.

► With respect to claims 18-25, Watkins et al (figs 1-8, text [0001]-[0048]) discloses the claimed method of removing a heat-affected zone ("HAZ") on a semiconductor substrate, comprising:

providing a silicon substrate having a HAZ (fig 2E, text [0036] &[0028]) wherein providing the silicon substrate (10) having the HAZ comprising forming the HAZ by laser ablation;

removing the HAZ without removing at least one of an exposed metal layer, an exposed oxide layer and an exposed nitride layer (fig 2E-2F, text [0028]-[0037], exposed layer 30 is not removed) present on the silicon substrate (10) by exposing the silicon substrate to an etch solution comprising a tetramethylammonium hydroxide

(TMAH) and at least one organic solvent (propylene glycol), the at least one organic solvent (propylene glycol) comprises at least one hydroxyl group, the at least one organic solvent having at least one hydroxyl group (propylene glycol) that dissociates and forms at least one hydroxyl ion (propylene glycol dissociates and form at least hydroxyl ion); and

removing at least a portion of the silicon substrate other than within the HAZ with the etch solution (figs 2E-2F).

► With respect to claims 45-49 and 53-54, Watkins et al (figs 1-8, text [0001]-[0048]) discloses the claimed method of forming an aperture in a through-wafer interconnect comprising:

exposing a silicon substrate (10, fig 2E, text [0036] & [0028]) to a laser beam (16) to form an aperture, wherein the laser beam forms a heat-affected zone (HAZ) on to silicon substrate;

exposing the silicon substrate to an etch solution comprising tetramethylammonium hydroxide (TMAH) and at least one organic solvent (text [0037]), the at least one organic solvent (propylene glycol) comprises at least one hydroxyl group, the at least one organic solvent having at least one hydroxyl group (propylene glycol) that dissociates and forms at least one hydroxyl ion (propylene glycol dissociates and form at least hydroxyl ion);

removing the HAZ without removing at least one of an exposed metal layer, an exposed oxide layer, an exposed nitride layer, and an exposed polyimide layer (fig 2E-

2F, text [0028]-[0037]: the exposed layer 30 is not removed) present on the silicon substrate (10);

removing the silicon substrate with the etch solution (TMAH and propylene glycol) to enlarge a diameter of the aperture (figs 2E-2F); and

filling the aperture with a conductive material (50, fig 3, text [0038]) to form a through-wafer interconnect.

► With respect to claims 55, 57-60 and 64, With respect to claims 45-49 and 53-54, Watkins et al (figs 1-8, text [0001]-[0048]) discloses the claimed method of forming an aperture in a through-wafer interconnect comprising:

exposing a silicon substrate (10, fig 2E, text [0036] & [0028]) to a laser beam (16) to form an aperture, wherein the laser beam forms a heat-affected zone (HAZ) on to silicon substrate;

removing the HAZ without removing at least one of an exposed metal layer, an exposed oxide layer and an exposed nitride layer present on the silicon substrate (figs 2E-2F: exposed layer 30 is not removed) by exposing the silicon substrate to a first etch solution comprising tetramethylammonium hydroxide (TMAH) and at least one organic solvent (text [0037] & [0028]), the at least one organic solvent (propylene glycol) comprises at least one hydroxyl group, the at least one organic solvent having at least one hydroxyl group (propylene glycol) that dissociates and forms at least one hydroxyl ion (propylene glycol dissociates and form at least hydroxyl ion);

removing at least a portion of the silicon substrate with a second etch solution to enlarge a diameter of the aperture (figs 2E-2F, text [0037]: a diameter of the aperture

36 is enlarged. **\*\*\*notice: interpreting the claim in a broad scope scope, the diameter of the aperture being enlarged by the second etch solution which is the same as the first etch solution used for removing the HAZ**); and

filling the aperture with a conductive material (50, fig 3, text [0038]) to form a through-wafer interconnect.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

**2. Claims 15-17, 26-28, 50-52, and 61-63 rejected under 35 U.S.C. 103(a) as being unpatentable over Watkins et al [US 2005/0077913] in view Sachem Spec Sheet 379, as submitted by IDS.**

► With respect to claims 15-17, 26-28, 50-52, and 61-63, the claimed range percentage of TMAH and propylene glycol are considered to involve routine optimization while has been held to be within the level of ordinary skill in the art. As noted in *In re Aller* 105 USPQ233, 255 (CCPA 1955), the selection of reaction parameters such as temperature and concentration would have been obvious.

"Normally, it is to be expected that a change in temperature, or in concentration, or in both, would be an unpatentable modification. Under some circumstances, however, changes such as these may be impart patentability to a process if the particular ranges claimed produce a new and unexpected result which is different

in kind and not merely degree from the results of the prior art...such ranges are termed "critical ranges and the applicant has the burden of proving such criticality... More particularly, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation."

See also *In re Waite* 77 USPQ 586 (CCPA 1948); *In re Scherl* 70 USPQ 204 (CCPA 1946); *In re Irmscher* 66 USPQ 314 (CCPA 1945); *In re Norman* 66 USPQ 308 (CCPA 1945); *In re Swenson* 56 USPQ 372 (CCPA 1942); *In re Sola* 25 USPQ 433 (CCPA 1935); *In re Dreyfus* 24 USPQ 52 (CCPA 1934).

**3. Claims 65-66 are rejected under 35 U.S.C. 103(a) as being unpatentable  
Watkins et al [US 2005/0077913] in view of Takehiko et al [JP 06-041770].**

Watkins et al substantially discloses the claimed method except using the second etch solution comprising ammonium fluoride, phosphorous acid, water, hydrogen peroxide and at least one organic solvent.

However, Takehiko et al disclose the second etch solution comprising ammonium fluoride, phosphorous acid, water, hydrogen peroxide and at least one organic solvent for cleaning silicon.

Therefore, at the time of invention, it would have been obvious for those skilled in the art to modify process of Watkins et al by using the second etch solution comprising ammonium fluoride, phosphorous acid, water, hydrogen peroxide and at least one organic solvent for cleaning silicon substrate to provide a smooth silicon surface without contaminant.

***Response to Arguments***

4. Applicant's arguments with respect to claims 10-19, 21-28, 45-55, 57-66 have been considered but are moot in view of the new ground(s) of rejection.

***Allowable Subject Matter***

5. Claim 67 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

***Conclusion***

6. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thanhha Pham whose telephone number is (571) 272-1696. The examiner can normally be reached on Monday and Thursday 9:00AM - 9:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead can be reached on (571) 272-1702. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Thanhha Pham